

HARDY LAKE

2003 Fish Management Report

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HARDY LAKE

Scott and Jefferson Counties

Fish Management Report
2003

INTRODUCTION

Hardy Lake is a 741-acre impoundment located in Scott and Jefferson Counties, 6 miles east of Austin and about 3 miles north of State Road 256. The Indiana Department of Natural Resources (IDNR), through the Division of Parks and Reservoirs, has provided modern and primitive camping areas, a swimming beach with bathhouse, picnic areas, hunting zones, hiking trails, four concrete boat ramps, two fish cleaning stations, and two fishing piers. The fishing pier at the beach is handicapped accessible.

Alpha Marina provides seasonal mooring, rental rowboats, and gasoline. Approximately 65% of the lake is zoned for idle speed to accommodate anglers (Figure). IDNR launching permits are required on boats using the lake. Maps of the property are available from Hardy Lake State Recreation Area, 4171 East Harrod Road, Scottsburg, Indiana 47170.

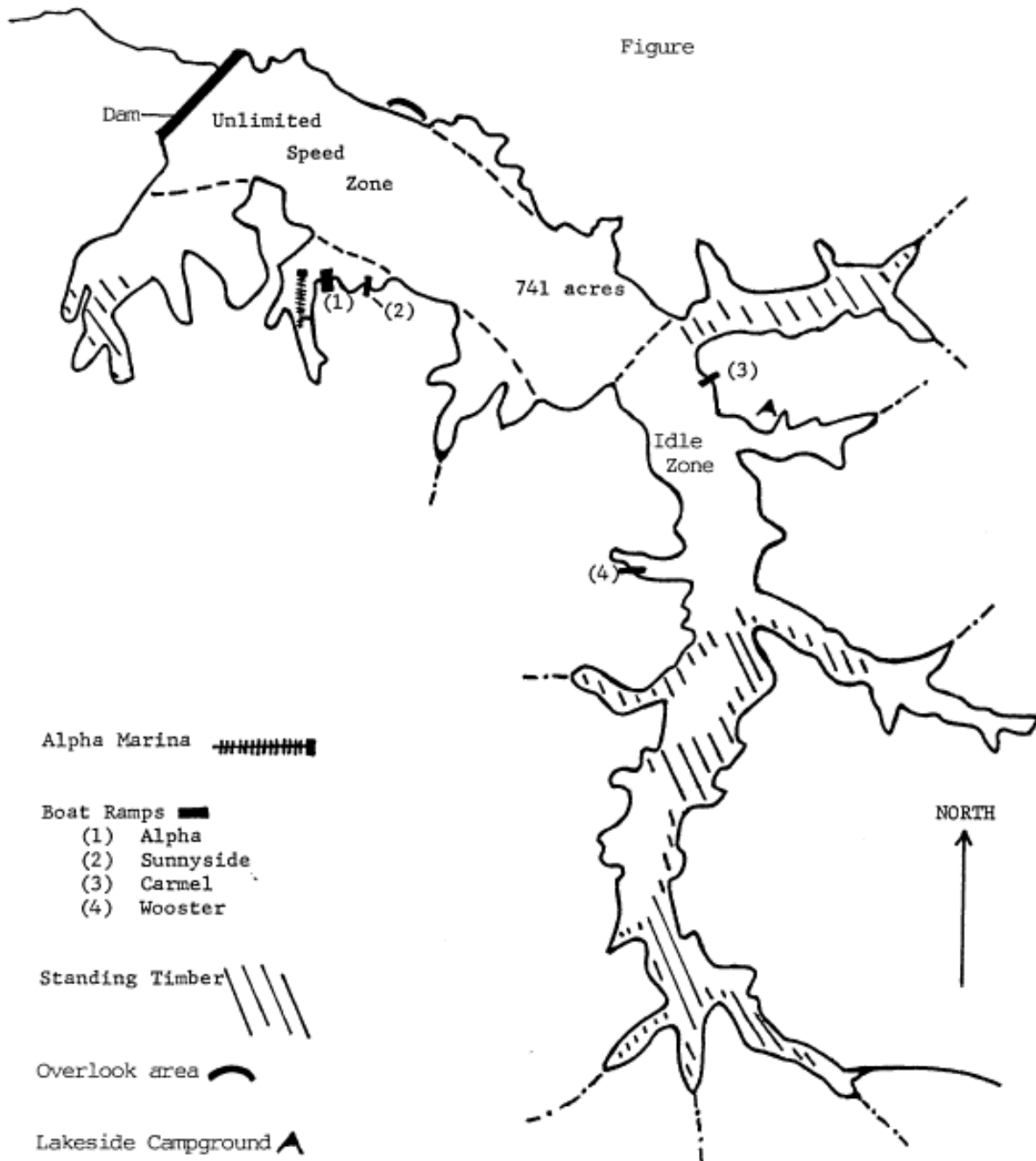
Largemouth bass, bluegill, redear sunfish, and black crappie were stocked into Hardy Lake for the IDNR by the Division of Fish and Wildlife (DFW) when construction was completed in 1970. As expected, these species have maintained their populations through natural reproduction. Other fishes that have been stocked at Hardy Lake and maintained through supplemental stockings by the DFW due to a lack of natural reproduction are listed in Table 1.

Table 1. Supplemental fish stocking record by DFW at Hardy Lake.

<u>Species</u>	<u>Number</u>	<u>Size range (inches)</u>	<u>Stocking date range</u>
Walleye	10,302,350	Fry	1970 through 1983
Northern pike	1,898	7 – 20	1976 through 1983
Tiger muskie	16,203	8 – 14	1985 through 1996
Muskie	8,847	8 – 13	1997 through 1998
Channel catfish	62,151	3 – 14	1970 through 2001

Numerous fishery surveys and several creel surveys have been conducted in the past to monitor fish populations and fish harvest at Hardy Lake. This survey was conducted to update information on fish harvest since the last creel survey in 1999 and information on largemouth bass, bluegill, gizzard shad, and aquatic vegetation since the last fish management survey in 2000. This work was done as part of work plan 200737.

Figure



HARDY LAKE

Hardy Lake State Recreation Area
Scott and Jefferson Counties

0 0.5 1.0 mile

METHODS

A fish management survey was conducted June 17-25, 2003. Some physical and chemical characteristics of the water were measured in the deep area of the lake near the principal spillway.

Fish were collected by DC electrofishing the shoreline at night with two dippers for 1.5 hours. Four experimental-mesh gill nets were fished overnight for three nights. Three trap nets were fished overnight for two nights. A global positioning system (GPS) device, Lowrance Globalnav 212, was used to record the location of the fish collection sites and the limnological data collection site (Datum = WGS-84, position format = Degree Minutes).

All fish collected were measured to the nearest 0.1-inch in total length. Average weights for fish by half-inch groups for Fish Management District 8 were used to estimate the weight of bluegill, redear sunfish, largemouth bass, black crappie, hybrid sunfish, and channel catfish collected in the sample. Other fishes were weighed in the field. Scale samples were taken from selected fishes for age and growth analysis. Electrofishing catch rates include all age groups of fish unless stated otherwise. Fish survey data are in the appendix.

Submersed aquatic vegetation was mapped in May, June, July, and August of 2001, and in June, July, and August of 2002. Vegetation was monitored along 12 transects in October of 2003. A Lowrance depth finder, Model X-15B, was used to find the edge of the weed beds. A planimeter and a map of Hardy Lake (Division of Water, March 1972) with 10-foot contours were used to estimate the area covered by submersed vegetation. Kinds of vegetation were noted visually. The Lowrance Globalnav 212 GPS was used to record the location of the vegetation transects.

The creel survey was conducted from April 1 through October 31, 2003. It was a non-uniform probability design (Fleener 1971). Four boat ramps and two shoreline areas were sampled based on angler use probabilities as estimated by the assistant property manager at Hardy Lake (Table 2). One site (Lakeside Campground), which was included in 1999, was dropped in this survey. The fishing pier at the marina that was covered separately in 1999 was monitored this time by the creel clerk while on duty at the Alpha Boat Ramp.

Table 2. Weight of sample sites and sample periods for creel survey at Hardy Lake, 2003.

<u>Sample Site</u>	<u>Sample Weight</u>	<u>Time of Day</u>	<u>Sample Weight</u>	<u>Day of Week</u>	<u>Sample Weight</u>
Alpha Ramp	0.40	A shift	0.40	Weekdays	0.025
Wooster Ramp	0.20	B shift	0.60		
Sunnyside Ramp	0.15			Weekdays	
Carmel Ramp	0.15			& Holidays	0.051
Dam shoreline	0.07				
Overlook	0.03				

The fishing day was divided into two 7.5-hour periods. The morning period (A shift) ran from 6 AM to 1:30 PM throughout the survey. The evening period (B shift) ran from 1:30 PM to 9 PM during April, May, September, and October. During June, July, and August, it ran from 2:30 PM to 10 PM to better cover the longer daylight period. The clerk sampled only one 7.5-hour period each day.

Sites, time periods, and dates to be sampled by the creel clerk were assigned based on the probabilities listed in Table 2. The clerk interviewed most anglers at the end of their fishing trip. However, some shore anglers still fishing at the end of a work shift were interviewed just before the clerk went off duty. Thus, some interviews are not for complete fishing trips.

Each interview included the start and stop time of fishing trip, number in fishing party, angler preference, and county of residence. Harvested fish were identified, counted, and measured to the nearest half inch in total length. The number of sublegal and legal largemouth bass, hybrid striped bass, and striped bass caught and released were recorded. Anglers were also asked to rate their satisfaction with their fishing experience at Hardy Lake that day.

Data were expanded separately for boat and shore by using a Quattro Pro spreadsheet. Expansion and standard errors were calculated according to a procedure developed for the Missouri Department of Conservation by Pam Haverland and adapted by Bob Ball, southern fisheries research biologist with DFW. Yield estimates (pounds of fish harvested) were calculated by half-inch groups using length frequency data with average weights from Hardy Lake surveys or other fishery surveys in southeastern Indiana. Trotline data for two parties is not included.

RESULTS AND DISCUSSION

FISHERIES SURVEY

Hardy Lake is approximately 39 feet deep. Light penetration into the water, as measured with a secchi disk, was 64 inches. As is typical for southern Indiana lakes in the summer time, Hardy Lake was stratified into warm and cold layers. Dissolved oxygen concentrations in the cold bottom layer were not adequate for fish survival below 16 feet. This stratified and anoxic condition is corrected each year during fall turnover when the water in the lake is mixed by the wind and falling temperatures. Hardy Lake was approximately 7 inches above normal pool.

A total of 1,887 fish representing 17 species, as well as hybrid striped bass and naturally occurring hybrid sunfish, was collected during this survey. Total weight of the fish sample was approximately 494 pounds. Species not collected in Hardy Lake this time but that have been collected in the past include common carp, northern pike, tiger muskie, muskie, white sucker, spotfin shiner, steelcolor shiner, bluntnose minnow, longear sunfish, green sunfish, spotted bass, and blackstripe topminnow.

Bluegill ranked first by number (54%) and third by weight (11%) in the survey sample. The bluegill electrofishing catch rate increased from 300 per hour in 2000 to 437 per hour in 2003, which represents an increase of 41% in bluegill density as measured by electrofishing. According to back-

calculated lengths, growth rates for all ages of bluegill have generally improved since last measured in 2000. The average age 4 bluegill is now 6.5 inches long compared to 5.9 in 2000 (Lehman 2001). Anglers caught bluegill up to 10 inches in the creel survey.

The Proportional Stock Density (PSD) for bluegill is the proportion or percentage of stock-size bluegill (≥ 3.0 inches) captured by electrofishing that are quality-size (≥ 6.0 inches). PSD values for balanced bluegill populations range from 20 to 60 (Anderson and Neumann, 1996). PSD values have declined from 16 in 2000 to 10 in this survey. A PSD of 10 indicates that 3 to 6-inch bluegill are high in abundance compared to bluegill longer than 6 inches. This could be due to a lack of predation on small fish and or heavy harvest of larger fish. It is estimated that anglers caught nearly 30,000 bluegill during the seven-month creel survey.

The Bluegill Fishing Potential (BGFP) Index is an objective rating system developed in Indiana to assess bluegill fishing in lakes and ponds (Ball and Tousignant, 1996). Out of a possible 40 points in the index, the current bluegill fishery scored 16 points, which falls within the fair category (Table 3). The BGFP Index score in 2000 was 18 points. The slight decline in the score can be attributed to the decline in the bluegill PSD.

Table 3. Range of scores for each category in the bluegill fishing potential index.

<u>POOR</u>	<u>MARGINAL</u>	<u>FAIR</u>	<u>GOOD</u>	<u>EXCELLENT</u>
0 – 7.0	7.1 – 12.9	13.0 - 18.9	19.0 - 25.9	26.0 – 40.0

Gizzard shad, which ranged in size from 9.5 to 14.9 inches, ranked second by number (17%) and first by weight (36%) in the sample. Electrofishing catch rates increased from 89 per hour in 2000 to 133 per hour in 2003 (Lehman 2001).

A total of 176 redear sunfish were collected that ranged in size from 2.4 to 9.9 inches. They ranked third by number and fourth by weight in the sample. Fifty-nine redear over 4 inches (stock size) were collected by electrofishing. Seventeen (29%) of these fish were 7 inches (quality size) or longer. Redear are reaching 7 inches during their fourth year of life. It is estimated that anglers caught 10,000 redear during the seven-month creel survey.

Largemouth bass ranked fourth by number (9%) and second by weight (20%) in the sample. They ranged in length from young-of-the-year to 15.8 inches and averaged 9.8 inches. Bass electrofishing catch rate declined from 125 per hour in 2000 to 98 per hour in 2003 representing a decline of 22% in the catch rate.

The Proportional Stock Density (PSD) for largemouth bass is the proportion or percentage of stock-size bass (≥ 8.0 inches) captured by electrofishing that are quality-size (≥ 12.0 inches). PSD values for balanced largemouth bass populations range from 40 to 70 (Anderson and Neumann, 1996). The PSD value for bass at Hardy Lake has improved from 21 in 2000 to 32 in this survey.

Only 15 black crappies were collected in the fishery survey. Seven were longer than 8 inches (quality size). The average crappie appears to be reaching 8 inches sometime in its third year of growth, as was the case in 2000. It is not unusual for crappie to be undersampled in routine fishery surveys.

The striped bass, which is an open-water predator, feeds on gizzard shad. Thus, it was recommended in 2000 (Lehman 2001) that the DFW introduce striped bass fingerlings (also called “stripers”) into Hardy Lake in 2001 to feed on the over-abundant shad. If striped bass were not available, hybrid striped bass could be substituted. This hybrid is made by crossing a male white bass with a female striped bass. It is often called a “wiper” and sometimes is also called a “palmetto bass” (Rudacille and Kohler, 2000).

Stripers were stocked in 2001 and wipers were stocked in 2002. Neither fish was available in 2003 (Table 4). Nine hybrid striped bass and three striped bass were collected during the fisheries survey. The average striped bass was 14 inches long after only 2 years of growth.

Table 4. Stocking record for striped bass and hybrid striped bass by DFW at Hardy Lake.

<u>Species</u>	<u>Number</u>	<u>Length (inches)</u>		<u>Stocking Date</u>
		<u>Average</u>	<u>Range</u>	
Striped bass	7,410	1.20	1.1 - 1.6	May 31, 2001
Hybrid striped bass	7,410	1.66	1.3 - 1.8	June 19, 2002
				None available in 2003

Prior to this survey, 3,480 triploid grass carp had been purchased and stocked by Hardy Lake personnel to control submersed aquatic vegetation (Table 5). A 17-pound grass carp was collected in this survey. Anglers reported catching and releasing two grass carp during the creel survey that weighed between 30 and 35 pounds. Warmouth, along with a few hybrid sunfish, bullheads, and an occasional walleye are also present in Hardy Lake. These fish add some variety to angler harvest.

Table 5. Triploid grass carp stocking record by Division of State Parks and Reservoirs for Hardy Lake.

	<u>Number Stocked</u>	<u>Size Range (Inches)</u>	<u>Stocking Date</u>
	1,150	8 to 11	June 18, 1996
	600	8 to 12	November 22, 2000
	700	8 to 12	June 20, 2001
	<u>1,030</u>	8 to 12	September 20, 2002
Total	3,480		

VEGETATION SURVEY

Eurasian watermilfoil and coontail are the dominant submersed plants in Hardy Lake. Coontail is especially thick in the upper end of the lake. It is often at the surface by late May and can be found as deep as 12 to 14 feet. Naiads begin to appear in May and are very noticeable by July. Lotus and purple loosestrife start blooming in July. Eurasian watermilfoil and purple loosestrife are invasive, exotic plant species.

In 2001, it was estimated that submersed plants covered 237 acres of Hardy Lake. This is 32% of the lake's area, which is higher than the optimum level of 20 to 25% for largemouth bass and bluegill management. It was estimated that submersed vegetation also covered 237 acres in 2002.

It was estimated that submersed aquatic vegetation and lotus covered 35% (260 acres) of Hardy Lake in 2003. Anglers often complain to Hardy Lake personnel about the "weeds" because they interfere with fishing. Some of them also stated to the creel clerk that less vegetation would increase fishing trip satisfaction. Excess vegetation also interferes with fisheries management. A reduction in submersed vegetation to 20 or 25% should improve bass predation on bluegill, benefiting both species.

CREEL SURVEY

Fishing Pressure and Harvest Rates by Month

A total of 154 days were sampled during the 214-day creel period from April 1 through October 31, 2003. During that time, the creel clerk interviewed 2,129 anglers (1,873 boat and 256 shore). Only one boat angler refused an interview. With the exception of two boat anglers and 69 shore anglers, interview data are for completed fishing trips. After expanding and combining boat and shore data, it was estimated that 21,502 anglers spent 80,084 hours fishing at Hardy Lake during the survey period (Table 6). Total fishing pressure equaled 108 hours per acre during the survey. Fishing pressure peaked in July at 15,997 hours and then declined to a low of 5,195 hours in October (Table 6).

The creel clerk came in contact with two angler parties in June that were fishing with trotlines. The data (effort = 24.5 hours; harvest = six channel catfish, three bullheads, two bluegill, and one largemouth bass) were recorded but not included in this survey.

The best harvest rate of 0.92 fish per hour was observed in July. The lowest harvest rate of 0.35 fish per hour was observed in September. During this 7-month survey, the overall harvest rate equaled 0.71 fish per hour (Table 6). This is 61% higher than the rate of 0.44 fish per hour observed in the 1999 creel survey.

Table 6. Estimated number of anglers, hours spent fishing, number of fish harvested, and harvest rates by month during the 2003 creel survey at Hardy Lake. Boat and shore data are combined.

<u>Month</u>	<u>Number of Anglers</u>	<u>Fishing Pressure (Hours)</u>	<u>Number of Fish Harvested</u>	<u>Harvest Rate (Fish per Hour)</u>
April	3,349	13,502	10,559	0.78
May	4,007	15,635	12,485	0.80
June	3,860	13,452	7,400	0.55
July	4,613	15,997	14,700	0.92
August	2,771	10,064	5,079	0.50
September	1,594	6,237	2,198	0.35
October	<u>1,308</u>	<u>5,195</u>	<u>4,160</u>	0.80
Totals	21,502	*80,084	56,580	0.71

*Total fishing pressure = 80,084 hours per 741 acres = 108.1 hours per acre.

Angler Preference

To measure their preference, the creel clerk asked anglers the following question: "What were you fishing for?" Responses from the 2,128 anglers that were interviewed fit into 12 categories (Table 7).

Forty-two percent of the anglers at Hardy Lake indicated they were fishing for largemouth bass. Hardy is a popular spot for bass tournaments by local bass clubs and a number of these anglers were interviewed during the survey. Twelve percent of the anglers were fishing for bluegill, 9% for crappie, and 3% for channel catfish. Twenty percent of the anglers were fishing for various combinations of these four species. Thirteen percent of the anglers did not have a preference for any certain kind of fish. These anglers were fishing for "anything" (Table 7).

Stripers and wipers were stocked in 2001 and 2002 respectively. Although these stockings were never advertised, nearly 1% of the anglers said they were fishing for those fish.

Table 7. Preference categories of anglers fishing at Hardy Lake from April 1 through October 31, 2003.

<u>Preference Category</u>	<u>Number of Anglers</u>	<u>Percent of Anglers</u>
Largemouth bass	893	42.0
Anything	277	13.0
Bluegill	260	12.2
Panfish	220	10.3
Crappie	186	8.7
Largemouth bass and panfish	170	8.0
Channel catfish	56	2.6
Channel catfish and panfish	40	1.9
Striped bass	9	0.4
Hybrid striped bass	8	0.4
Redear sunfish	5	0.2
Largemouth bass and muskie	<u>4</u>	0.2
Totals	2,128	100.0

Harvest by Number and Weight

The creel clerk counted and identified 5,049 fish at Hardy Lake during the 7-month creel survey. After expansion of the data, it is estimated that 56,580 fish weighing approximately 23,923 pounds were harvested during the survey (Table 8). This is a yield of approximately 76 fish per acre that weighed 32.28 pounds per acre.

Bluegills were the most abundant fish in the harvest by number (53%) and by weight (37%). They ranged in size up to 10.0 inches and averaged 7.4 inches long (Table 8). The average bluegill in the 1999 creel survey was 6.1 inches long (Lehman 2000). Approximately 97% of the bluegills in the harvest were quality size (≥ 6 inches) and 34% were preferred size (≥ 8 inches).

Crappies ranked second by number and weight in the harvest. They ranged in length from 5.5 to 14.5 inches. Approximately 91% were quality size (≥ 8 inches). Of the 2,128 anglers interviewed, only three anglers harvested a bag limit of 25 crappies. Seventy-one percent of the crappies were harvested in April. The second highest harvest occurred in June with 7 percent.

Table 8. Estimated number and weight of fishes harvested at Hardy Lake from April 1 through October 31, 2003. Average length and size range is also listed.

<u>Species</u>	<u>Number</u>	<u>Percent By Number</u>	<u>Weight (Pounds)</u>	<u>Percent By Weight</u>	<u>Average Length (Inches)</u>	<u>Size Range (Inches)</u>
Bluegill	29,817	52.7	8,927.53	37.3	7.4	3.5-10.0
Crappie	12,208	21.6	5,245.48	21.9	9.3	5.5-14.5
Redear sunfish	10,020	17.7	4,029.79	16.8	8.0	5.0-10.0
Largemouth bass	1,620	2.9	2,749.12	11.5	14.8	12.0-22.0
Warmouth	950	1.7	346.33	1.4	7.7	5.0-9.5
Channel catfish	940	1.7	1,908.20	8.0	17.0	9.0-27.5
Hybrid striped bass	492	0.9	420.84	1.8	12.2	7.0-14.5
Hybrid sunfish	348	0.6	123.49	0.5	7.7	5.5-9.0
Other*	81	0.1	42.07	0.2	NA	NA
Bullhead	57	0.1	53.30	0.2	11.9	10.5-13.5
Striped bass	40	0.1	65.33	0.3	16.0	15.5-16.5
Walleye	7	0.0	11.41	0.0	16.5	16.5
Totals	56,580	100.0	23,922.89	100.0		

*Other = bowfin, gizzard shad, golden shiner, green sunfish, and longear sunfish.

Redear sunfish ranked third by number and weight in the harvest. They ranged in length from 5 to 10 inches. Approximately 88% were quality size (≥ 7 inches). Of the 2,128 anglers interviewed, none harvested the legal daily bag limit of 25 redear.

More anglers said they were fishing for largemouth bass than any other species at Hardy Lake. Based on 156 largemouth bass handled by the creel clerk in this survey, including 3 sublegal bass, it is estimated that anglers harvested 1,620 bass that averaged 14.8 inches (Table 8).

Bass harvest moved up from sixth by number in 1999 when it was estimated that 372 bass (14 to 18 inches) were harvested (Lehman 2000) to fourth by number in this survey. No one harvested a legal bag limit of five largemouth bass.

Channel catfish ranked sixth by number (nearly 2%) and fifth by weight (8%) in the harvest (Table 8). The average channel catfish in the harvest was 17 inches long. Supplemental stockings of 8-inch channel catfish every 2 years maintain this species in Hardy Lake. Prior to this survey, 62,151 channels had been stocked into Hardy Lake. Popular catfishing sites for shoreline anglers are the dam and the overlook area.

It is estimated that 492 hybrid striped bass and 40 striped bass were harvested (Table 8). Their average lengths were 12 and 16 inches, respectively.

It is estimated that seven walleye were harvested during this creel survey. This estimate is based on the observed harvest of one 16.5-inch walleye on April 28 by a bass angler. Also, a crappie angler reported releasing an 11-inch walleye on April 26. Anglers report harvesting an 8.5-pound walleye in 1998, a 4.5-pound and an 8-pound walleye in 2002, and a 4.5-pound walleye in 2003. Some successful reproduction by walleye may be occurring in the lake.

Catch and Release Fishing

Each party, when interviewed by the creel clerk, was asked for the number and size of largemouth bass, hybrid striped bass, and striped bass that had been caught and released. From this information, it was estimated that anglers caught and released 48,892 largemouth bass, 579 hybrid striped bass, and 186 striped bass (Table 9). This included 7,587 legal largemouth bass. Anglers reported releasing one 9.25-pound largemouth bass as well as some that weighed 5, 6, and 7 pounds.

Bass anglers routinely practice catch-and-release. During this creel survey, it was estimated that anglers caught 9,207 legal largemouth bass. Eighteen percent (1,620) were harvested and 82% (7,587) were released. The total catch rate (harvest rate plus release rate) for largemouth bass at Hardy Lake during this creel survey was 0.63 largemouth bass per hour. This is 29% higher than the total catch rate of 0.49 bass per hour observed in the 1999 creel survey (Lehman 2000).

Table 9. Estimated number and catch rates for largemouth bass, hybrid striped bass, and striped bass caught and released by anglers at Hardy Lake from April 1 through October 31, 2003.

<u>Species</u>	<u>Estimated Number</u>	<u>Catch Rate (Fish per Hour)</u>
Largemouth bass (< 14.0 inches)	41,305	0.516
Largemouth bass (\geq 14.0 inches)	7,587	0.093
Total largemouth bass	48,892	0.611
Hybrid striped bass (< 17.0 inches)	579	0.007
Hybrid striped bass (\geq 17.0 inches)	0	0
Striped bass	186	0.002

Angler Satisfaction

Each angler party was asked the following question, “On a scale of 0 to 10 with 0 being *not satisfied at all* and 10 being *extremely satisfied*, how would you rate your satisfaction with your fishing experience at Hardy Lake today?” Approximately 34% of the angler parties were less than satisfied and rated their fishing experience from 0 through 4. Nineteen percent were “neutral” and rated their fishing experience as a 5. The remaining 46% were satisfied and rated their fishing experience from 6 through 10. One percent of the angler parties did not rate their fishing experience (Table 10).

Anglers are more satisfied now than during the creel survey in 1999. At that time 49% of the parties were less than satisfied, 20% were neutral, and only 31% were satisfied (Lehman 2000).

Table 10. Satisfaction ratings by angler parties at Hardy Lake from April 1 through October 31, 2003.

<u>Satisfaction Rating</u>	<u>Number of Angler Parties</u>	<u>Percent</u>
0 “Not satisfied at all”	79	6.9
1	30	2.6
2	104	9.0
3	92	8.0
4	85	7.4
5 “Neutral”	216	18.8
6	117	10.2
7	133	11.6
8	138	12.0
9	46	4.0
10 “Extremely satisfied”	100	8.7
No rating given	11	1.0
Totals	1,151	100.0

Each angler party was also asked the following question, “What would increase your satisfaction with your fishing experience at Hardy Lake?” The clerk recorded 1,151 responses, which were sorted into six categories as follows: biological 499, satisfied 457, social 77, facilities 62, other 29, and environmental 27.

Forty-three percent of the comments fit into a category that could be labeled as biological. Within this category of angler responses, 26% wanted to catch bigger fish, 22% wanted less weeds including less lotus, 19% wanted to catch more fish, 15% wanted a slot size limit, 6% wanted to catch fish, and approximately 3% wanted walleye restocked. A few anglers want to see catfish, striped bass, and hybrid striped bass stockings continued. Several anglers want northern pike, crappie, and largemouth bass restocked. Two anglers want the muskie, northern pike, and striped bass removed from the lake because they are eating too many bluegill and crappie.

Forty percent of the angler parties made the simple statement that they were “satisfied” with their fishing experience. This large group of anglers did not offer anything that would increase their satisfaction.

Approximately 7% of the comments fit into a category that could be labeled as social. Anglers said they would be more satisfied if they had more experience, if they had more time, if the entire lake was an idle zone, if fees were reduced, if tournament pressure was reduced, if jet skis were banned, and if outboard horsepower was limited, etc. Nearly 43% of the comments, the single largest group in this category, expressed the opinion that there were too many pleasure boaters at Hardy Lake.

Approximately 5% of the comments fit within the facilities category. Among other things, angler parties requested more enforcement (especially of speed limits), stumps cut off or marked, channels and shallow areas marked, a dock at the Carmel ramp, more places to fish along the shoreline, and trash cans. These comments have been passed on to the manager at Hardy Lake.

A small group of angler parties (2.5%) fit into the “other” category. Twenty-eight of the parties did not comment and eleven in this group did not rate their fishing experience (Table 10). One party of six anglers suggested that the survey report be posted on the web.

Another small group of angler parties (2.3%) said that better weather would make their fishing experience more satisfying. This environmental category also included several anglers that wanted the mosquito population reduced.

Angler Origin and Economic Value of the Hardy Lake Fishery

The creel clerk interviewed angler parties from 41 counties in Indiana and from other states, including California, Florida, Illinois, Kentucky, Ohio, New Jersey, and Wisconsin (Table 11). If the party consisted of anglers from more than one county, the location of the first angler was used to represent the group. Of the 1,151 angler parties interviewed during this survey, 22% were from Scott County, where the lake is primarily located. Approximately 55% came from the five counties of Clark, Jackson, Jennings, Jefferson, and Washington immediately adjacent to Scott County. Approximately 18% came from 35 other counties in Indiana and nearly 6% came from outside the state.

In 2001, the U.S. Fish and Wildlife Service determined that the value of one angler’s fishing trip in Indiana was \$36.56 (U.S. Department of the Interior, et al. 2002). This figure includes expenditures for food, lodging, transportation, equipment, license fees, and related fishing expenditures. Based on the number of anglers, it is estimated that there were 21,502 fishing trips to Hardy Lake during the 7-month period covered by this creel survey. At \$36.56 per trip, the estimated economic value of fishing during the creel survey period was approximately \$786,113. Fishing at Hardy Lake is very important to the local and state economy.

Table 11. Origin of angler parties in creel survey at Hardy Lake, April 1 through October 31, 2003.

<u>Indiana County</u>	<u>Total Number</u>	<u>Percent</u>	<u>Indiana County</u>	<u>Total Number</u>	<u>Percent</u>
Scott	250	21.7	Hendricks	2	0.2
Clark	231	20.1	Rush	2	0.2
Jackson	185	16.1	Tippecanoe	2	0.2
Jennings	103	8.9	Wayne	2	0.2
Jefferson	89	7.7	Adams	1	0.1
Bartholomew	35	3.0	Brown	1	0.1
Floyd	35	3.0	Gibson	1	0.1
Washington	24	2.1	Grant	1	0.1
Decatur	20	1.7	Huntington	1	0.1
Johnson	15	1.3	LaPorte	1	0.1
Marion	15	1.3	Lawrence	1	0.1
Shelby	15	1.3	Morgan	1	0.1
Ripley	8	0.7	Noble	1	0.1
Allen	6	0.5	Ohio	1	0.1
Dearborn	6	0.5	Owen	1	0.1
Harrison	6	0.5	Pulaski	1	0.1
Henry	6	0.5	Putnam	1	0.1
Switzerland	6	0.5	St. Joseph	1	0.1
Delaware	4	0.3	Union	1	0.1
Hamilton	3	0.3	Wells	1	0.1
Hancock	2	0.2	Out-of-state	<u>63</u>	<u>5.5</u>
			Totals	1,151	100.0

SUMMARY AND RECOMMENDATIONS

Gizzard shad were first documented in Hardy Lake in 1987 when six were collected. Since that time, their numbers have expanded so that in every fisheries survey since 1998, shad have ranked second in abundance by number and first in abundance by weight compared to other fish in the lake. Shad represent two potential problems for the Hardy Lake fishery: diversion of bass predation away from bluegill and competition with more desirable species.

It is true that small gizzard shad provide forage for many fishes such as largemouth bass and crappies. However, this can lower the predation rate by largemouth bass on small bluegills, which is needed to keep bluegill numbers under control. Bluegill growth generally declines when bluegill are too abundant. At this time, bluegill growth in Hardy Lake is still acceptable for southeastern Indiana impoundments.

Another negative effect of shad can result from their competition with other fish for zooplankton. A large population of shad can eat so many of the microscopic animals that fewer and fewer young bass and bluegill, which also eat those small animals, will survive. Fishing can then deteriorate so badly that a complete renovation of the watershed and impoundment is necessary. It is not known why, but neither bass nor bluegill fishing has "crashed" at Hardy Lake yet.

Fish survey results indicate that numbers of bluegill and growth rates of bluegill in Hardy Lake have improved since 2000. The average age-4 bluegill is now 6.5 inches long compared to 5.9 in 2000. Although down slightly since 2000, the bluegill fishing index is still in the fair category.

Largemouth bass appear to be reaching the legal size limit of 14 inches during their sixth year of growth which is average for southeastern Indiana impoundments. Of 170 bass collected in this fisheries survey, 10 (6%) were 14 inches long or longer which is up from 2% in 2000. Bass growth rates have improved slightly since last measured in 2000 (Lehman 2001). However, the electrofishing catch rate of 98 bass per hour is down 22% compared to 2000 when it was 125 bass per hour. Apparently bass numbers have declined during the past 3 years to the same level observed in 1999 when the bass catch rate was 97 bass per hour (Lehman 2000).

Striped bass were stocked in 2001 and hybrid striped bass were stocked in 2002 to utilize gizzard shad and to provide additional fishing opportunities. Nine hybrid striped bass and three striped bass were collected during the fisheries survey. The average striped bass was 14 inches long after only 2 years of growth. Anglers harvested 492 hybrid striped bass and 40 striped bass from April through October.

According to creel survey results, anglers harvested nearly 30,000 bluegill, over 12,000 crappie, 10,000 redear sunfish, and 950 warmouth. All of these numbers are up from 1999. A few hybrid sunfish, green sunfish, longear sunfish, and bullheads also were caught by panfish anglers.

Anglers harvested more largemouth bass in 2003 (1,620) than in 1999 (372) but their average size was slightly smaller at 14.8 inches compared to 15.2 inches in 1999. Approximately 41,000 sublegal bass were caught and released along with nearly 7,600 legal bass.

In 1999, only 31% of the angler parties were satisfied with their fishing experience at Hardy Lake. During this creel survey, 46% were satisfied which means that the number of satisfied anglers went up approximately 48% since 1999.

Some things listed by anglers this time that would improve their satisfaction were catching bigger fish, less weeds, catching more fish, a slot-size limit on largemouth bass, restocking walleye, reducing the number of pleasure boaters, having more time, making the entire lake an idle zone, reducing fees, reducing tournament pressure, banning jet skis, more enforcement (especially of speed limits), cutting off the stumps, a dock at the Carmel ramp, more places to fish along the shoreline, trash cans, and better weather.

Eurasian watermilfoil and coontail are the dominant submersed plants in Hardy Lake. Along with American lotus, submersed aquatic vegetation covered 35% (260 acres) of the lake in 2003. Anglers are dissatisfied with the "weeds" because they interfere with fishing. Excess vegetation also interferes with fisheries management. A reduction in vegetation to 20 or 25% of the lake's area should improve bass predation on bluegill, benefiting both species.

Triploid grass carp were introduced in 1996 at the conservative rate of only five fish per acre due to concerns about too much vegetation control if grass carp were stocked at the usual rate of 15 per

acre. However, no control of submersed vegetation was noticeable during the next 4 years as the vegetation was monitored. Additional grass carp were stocked in 2000 and 2001 at a very low rate of three per acre to replace the original fish (Table 5), which become less efficient at vegetation control as they age (Brunson 1994), and which were disappearing due to natural mortality.

It was recommended that 2,300 grass carp be stocked into Hardy Lake in 2002. Due to budget constraints, Hardy Lake personnel were only able to stock 1,030 fish or 45% of the recommended number. It was hoped that the remaining 1,270 grass carp would be stocked in 2003. However, due to budget constraints, Hardy Lake personnel were unable to stock any grass carp in 2003.

The primary fish management goals at Hardy Lake are: 1) maintain quality fishing opportunities for panfish (chiefly bluegills) and channel catfish; 2) maintain adequate bass growth to provide fishing opportunities for bass exceeding the size limit, and 3) create a striped bass and/or a hybrid striped bass fishery. In order to meet those goals, the following recommendations are made:

1. The DFW should maintain the 14-inch minimum size limit to prevent overharvest of largemouth bass, the primary source of predation on small panfish and gizzard shad in Hardy Lake. Contrary to angler opinion, the bass population in Hardy Lake has not stockpiled to the point that a 12 to 15-inch slot limit is necessary.
2. The DFW should continue to stock striped bass fingerlings (preferred) or hybrid striped bass fingerlings at 10 per acre to utilize gizzard shad and to provide additional fishing opportunities. Maintaining this open-water predator in Hardy Lake requires annual supplemental stockings. Survival and growth of these fish will be evaluated by DFW according to current work plan guidelines.
3. DFW and Hardy Lake personnel should work out a control plan that considers the use of triploid grass carp and herbicides, as well as Hardy Lake's floating mower, to reduce aquatic vegetation to levels more acceptable in fish management. Triploid grass carp stockings appear to have been too light and inconsistent to control submersed vegetation to date.
4. The DFW should continue to stock 4,446 channel catfish every 2 years. These channel catfish should average at least 8 inches long to reduce mortality from bass predation. The next regular stocking is scheduled for 2005.

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Date: February 21, 2005

APPENDIX

HARDY LAKE FISHERIES SURVEY DATA

